

Benefits and Cost Summary

Attachment 8 consists of the following items:

- ✓ **Project Costs and Benefits.** The body of this attachment provides an overview of the project costs and benefits of this proposed funding package, as well as the benefits associated with each individual project.
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The Proposal for the Upper Santa Margarita Watershed (USMW) IRWM offers a high level of benefit for the state relative to lifetime costs. Combined, the three projects in this application have a benefit to cost ratio of 1.5, showing that the benefits of these projects outweigh the costs. The three projects contained within this Proposal are:

- Recycled Water and Plant Material Conversion Project for HOA Common Areas (RWPMC) Project
- Native Botanical Garden (Garden) Project
- Upper Valle de Los Caballos Recharge Project (Upper VDC) Project

The monetized benefits of these projects are summarized in **Table 8-1** with detailed individual project Benefit/Cost analyses following this section.

Benefits and Cost Analysis

Benefits and Cost Analysis

Table 8-1: Benefits and Costs Summary

Project	Project Proponent	Total Present Value Costs	Total Present Value Benefits			D1 – Cost-Effectiveness Analysis	From Section D2 – Briefly describe the main Non-monetized benefits
			Section D3 Monetized	Flood Damage Reduction	Total		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
RWPMC	Rancho California Water District	\$568,316	\$765,209		\$765,209		<ul style="list-style-type: none"> • Improve water supply reliability by providing local, drought-resistant supply • Reduce net diversions from the Delta • Provide public education on irrigation water use efficiency measures and recycled water use • Improve water quality by reducing dry weather run-off • Benefit habitat by installing California friendly/native plants • Help meet state mandates for potable water conservation • Minimize fertilizer use given recycled water use
Garden Project	South Coast Resource Conservation & Development Council	\$170,801				N/A	<ul style="list-style-type: none"> • Decrease Regional irrigation demand through demonstrating the use of native plants and water use efficiency • Increase and enhance recreational space for DAC area • Create native plant ecosystems that improve local habitat • Provide public education on native plants, habitat and water use efficiency • Increased energy savings and reduced CO₂ emissions • Improved water quality through education on landscaping methods
Upper VDC	Rancho California Water District	\$15,795,549	\$24,923,501		\$24,923,501		<ul style="list-style-type: none"> • Improve groundwater quality by lowering TDS levels in the aquifer • Improve water supply reliability by maximizing local groundwater basin storage • Maximize use of existing resources (i.e., infiltration spreading basin, groundwater wells, and aquifer)
Total Costs		\$16,534,666	Total Benefits		\$25,688,710		Benefit/Cost Ratio: 1.55

**Recycled Water and Plant Material Conversion
Project for HOA Common Areas****Benefits and Cost
Analysis**

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Introduction

This attachment presents the economic analysis for the Recycled Water and Plant Material Conversion (RWPMC) Project. The following sections provide a brief description of the Project and a summary of the Project benefits and costs. Sections outlined in Exhibit D of the Integrated Regional Water Management Proposition 84 Implementation Round 2 Proposal Solicitation Package (PSP) are then provided, including: Non-Monetized Benefits Analysis (Section D2), Monetized Benefit Analysis (Section D3), and Project Benefits and Costs Summary (Section D5). Since this Project is not a DAC and does not provide flood damage reduction, there is no need for Section D1 (Cost-Effectiveness Analysis) or D4 (Flood Damage Reduction Benefits Analysis) to be included.

Project Description

The RWPMC Project is a program proposed by the Rancho California Water District (RCWD) to offset potable water use and increase outdoor irrigation efficiency at three Home Owners Association (HOA) common areas: Rainbow Canyon HOA, Meadowview HOA, and Paloma Del Sol HOA. The project consists of the following activities:

- Conversion of existing potable-water irrigation systems to efficient recycled water systems. This will include replacing inefficient irrigation systems with new components such as drip components, high efficiency nozzles, and smart irrigation controllers, as well as repairing and replacing damaged pipes.
- Hot-tapping of RCWD's recycled water mainline to use recycled water from the Temecula Valley Regional Water Reclamation Facility (TVRWRf) at the HOA sites.
- Replacement of high-water use plant material with drought tolerant and California friendly/native plant species.
- A public education component that will consist of installing signage and conducting workshops to inform the public on water use efficiency strategies and promote the importance of recycled water.

Summary Project Benefits and Costs

A summary of all benefits and costs of the project are provided in **Table 8-2**. Monetized benefits and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Benefits and Cost Analysis

Table 8-2. Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	\$568,316
Monetizable Benefits	
Avoided Costs of MWD Water Imports - WUE (14 afy/30 yrs)	\$242,947
Avoided Costs of MWD Water Imports – RW (29 afy/30 yrs)	\$503,247
Reduced Social Costs of Carbon Emissions (49 MT/30 yrs)	\$19,014
Total Monetizable Benefits	\$765,209
<i>Qualitative Benefit or Cost</i>	Qualitative Indicator*
Provides education or technology benefits	+
Provides social recreation or access benefits	+
Helps avoid, reduce, or resolve various public water resource conflicts	+
Benefits wildlife or habitat in ways that were not quantified in Attachment 7	+
Improves water quality in ways that were not quantified in Attachment 7	+
Reduces demand for net diversions for the regions from the Delta	+
Improves water supply reliability in ways that were not quantified in Attachment 7	+
Reduces fertilizer costs for recycled water customers	+

* Direction and magnitude of effect on net benefits:

+ = Likely to increase net benefits relative to quantified estimates.

++ = Likely to increase net benefits significantly.

– = Likely to decrease net benefits.

– – = Likely to decrease net benefits significantly.

U = Uncertain, could be + or –.

Non-Monetized Benefits Analysis (Section D2)

Table 8-3 shows the non-monetized benefits checklist for the project. Narrative descriptions of the benefit categories marked “Yes” in the following the tables are provided in the narrative description of qualitative benefits section after the table.

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Benefits and Cost Analysis

Table 8-3 (PSP Table 12) Recycled Water and Plant Material Conversion Non-monetized Benefits Checklist		
	Community/Social Benefits: Will the project	
1	Provide education or technology benefits?	Yes
2	Provide social recreation or access benefits?	Yes
3	Help avoid, reduce or resolve various public water resources conflicts?	Yes
4	Promote social health and safety?	No
5	Have other social benefits?	No
	Environmental Stewardship Benefits: Will the project	
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7?	Yes
7	Improve water quality in ways that were not quantified in Attachment 7?	Yes
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No ¹
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3 or D4?	No
	Sustainability Benefits: Will the project	
10	Improve the overall, long-term management of California groundwater resources?	No
11	Reduce demand for net diversions for the regions from the Delta?	Yes
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No ¹
14	Improve water supply reliability in ways not quantified in Attachment 7?	Yes
15	Other: Result in avoided fertilizer costs for recycled water customers	Yes

¹ This benefit category is marked as no because it was already described as a physically quantified benefit in Attachment 7.

Narrative Description of Qualitative Benefits

Provides education or technology benefits

This project includes public outreach activities, including workshops and site signage, to demonstrate to the local community the benefits of irrigation system retrofits and use of California friendly and native landscapes, and to promote the importance of recycled water use. Outreach programs can also lead water customers to additional water conservation and water use efficiency programs or practices besides those outlined in the RWPMC project.

**Recycled Water and Plant Material Conversion
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Analysis****Provide social recreation or access benefits**

By switching to recycled water, the HOAs participating in the Project will no longer be subject to watering restrictions during times of drought and can continue to irrigate their landscape areas regardless of drought conditions (thus remaining green during dry periods). In addition, less water will be required overall for the native landscaping. This will improve the aesthetics and enjoyment of the HOA common areas and, in extreme cases, may avoid closures of common areas that would otherwise be necessary to prevent further turf damage.

Helps avoid, reduce or resolve various public water resources conflicts

Due to many natural and human forces, such as rapid population growth, water scarcity has become an increasingly pertinent issue to water resource planners and lawmakers, especially with regards to imported water. The Water Conservation Act of 2009, or Senate Bill X7-7 (SBX7-7), outlines statewide water conservation targets for both urban and agricultural water customers. Water savings achieved through the RWPMC project will help RCWD to meet state targets outlined in SBX7-7 of a 10% reduction in potable water demand by the end of 2015, and a 20% reduction in potable water consumption by 2020. The project also helps to meet statewide goals to increase use of recycled wastewater by at least 1 million acre feet per year (AFY) by 2020 and by at least 2 million AFY by 2030 (SWRCB, 2009).

Benefits wildlife or habitat in ways that were not quantified in Attachment 7

By modifying landscape, HOA sites are removing non-native turf and other high water use plants and substituting them with drought-resistant native Southern California plant species. By increasing the coverage of native plant species in the area, this increases the natural and native terrestrial habitat in the Region and could encourage existing animal species with limited habitat to benefit from this area.

Improves water quality in ways that were not quantified in Attachment 7

The Project will reduce existing dry weather irrigation run-off by increasing irrigation efficiency at the three project sites. Runoff from landscaped areas can contain various contaminants, including nutrients from fertilizers, pesticides, and trash, which can reduce the quality of local receiving waters, including Temecula and Murrieta creeks, and ultimately the Santa Margarita River and the Santa Margarita Lagoon. Since each of these creeks/rivers is a 303(d) listed water body for both non-point and point source contaminants, installation of efficient water systems will help restore the water quality impairments by reducing the transport of contaminant loads from reduced dry-weather runoff.

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The *Residential Runoff Reduction Study* completed by the Municipal Water District of Orange County and Irvine Ranch Water District in 2004 (**Appendix F**) provides the basis for the correlation between the use of irrigation system controllers and the decrease in runoff at the site and subsequent decrease in contaminant transport to local water bodies. Although quantitative results were published, they could not be easily translated to quantitative assumptions for this Project – so only a qualitative benefit can be justified for the Project.

Reduces demand for net diversions for the regions from the delta

The Project will use recycled water to offset the highest cost supply used by RCWD, which is Treated Tier 2 supply purchased from the Metropolitan Water District of Southern California (MWD) through Eastern Municipal Water District (EMWD) and Western Municipal Water District (WMWD). EMWD and WMWD purchase imported water supply from MWD, which obtains its water from both the State Water Project (SWP) and the Colorado River Aqueduct. Currently, about three-quarters of WMWD and EMWD's water supply comes from the SWP (RCWD, 2011). Thus, it is assumed that the Project will offset about 32 AFY of SWP water (75% of the total 43 AFY).

Delta resources are in a state of crisis. Fish populations, including salmon and Delta-smelt, have declined dramatically in recent years. The levee system is aging, and the vulnerability of the Delta to flooding, sea level rise, or a major earthquake has contributed to concerns about possible levee collapse. In addition, water quality problems continue, and there is little consensus on how to manage water resources through storage. The Delta serves as home to hundreds of plant, animal, and fish species – some of which are listed as threatened or endangered. The Delta's 1,600 square miles of marshes, islands, and sloughs support at least half of migratory water birds on the Pacific Flyway and 80% of California's commercial fisheries (AECOM, 2012).

Improves water supply reliability in ways not quantified in Attachment 7

The Project will improve the overall reliability of RCWD supply by offsetting a portion of treated imported supply with recycled water supply produced by RCWD. The reliability of RCWD's imported supply from MWD has been and will continue to be vulnerable to a number of natural and human forces, including: transmission interruption from earthquakes, increasing municipal demands, limited and potentially decreasing snow pack and Bay-Delta flows (due to climate change), Bay-Delta ecosystem issues (and associated regulations), and water rights determinations. These vulnerabilities have and potentially will continue to result in increases in SWP and Colorado River Aqueduct supply cutbacks.

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Only a few studies have directly attempted to quantify the value of water supply reliability (i.e., through nonmarket valuation studies; see for example Carson and Mitchell, 1987, CUWA, 1994, Griffen and Mjelde, 2000, Raucher et al., 2013). Results from these studies indicate that residential and industrial (i.e., urban) customers seem to value supply reliability quite highly. Stated preference studies find that water customers are willing to pay approximately \$100 to more than \$500 per household per year in 2012 dollars for total reliability (i.e., a 0% probability of their water supply being interrupted in times of drought).

The challenge in applying these values to determine a value of increased reliability as a result of the RWPMC Project is recognizing how to reasonably interpret these survey-based household monetary values. The values noted above reflect a willingness to pay per household to ensure complete reliability (zero drought-related use restrictions in the future), whereas the RWPMC Project only enhances overall reliability and does not guarantee 100% reliability. Thus, if applied directly to the number of households within the MWD service area, the dollar values from the studies would overstate the reliability value provided by the project.

A simple way to roughly adjust for this “whole versus part” problem is to attribute a portion of the total value of reliability to the portion of the problem that is solved by the project. To adjust for the partial improvement in reliability from the RWPMC Project, it is assumed that household willingness to pay for improved reliability is directly proportional to the amount of recycled water that will offset imported water, as a percentage of the total potable water supply. This represents the percentage of total supply that has been improved in terms of overall reliability (i.e., by offsetting imported water demand with local sources).

For example, the Project will offset more than 43 AFY of imported water beginning in 2015. In 2020, total water demand within RCWD’s service area will be about 73,500 AFY (without the project) (RCWD, 2011). Thus, about 0.06% of total demand will be met by the Project’s recycled water. To obtain a lower bound estimate for the value of improved reliability associated with this water, it is assumed that households within the RCWD service area are willing to pay about \$0.06 per year (\$100 multiplied by 0.06%). Given the approximately 46,572 households¹ within the RCWD service area, this would result in \$2,794 of benefits in 2020. Taking into account increasing population and changing demands, this calculation could be completed for each year of the project’s useful life. However, due to the uncertainty involved in applying these numbers

¹ Based on a census estimate of 3.14 persons/household for Riverside County and RCWD UWMP’s 2020 population estimate of 146,237

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to this situation, this benefit estimate is not included in the tables. However, it is provided here to give an idea of the potential magnitude of this benefit.

Avoided fertilizer costs for recycled water customers

Due to nutrients in the recycled water (including total nitrogen, phosphorous, and potassium) and reduced fertilizer requirements associated with native Southern California landscaping, the HOAs receiving recycled water for landscape irrigation purposes will be able to reduce the amount of fertilizer applied to their landscape each year.

Monetized Benefit Analysis (Section D3)

Several monetized benefits are expected to accrue over the expected 30-year life of the project. Those include the avoided cost of imported MWD water and fertilizer cost savings.

Avoided Cost of Imported MWD Water

Although RCWD uses a mix of MWD imported water (both raw and treated) and local sources to supply their customers, imported water is the most expensive source to provide. To meet potable demand, RCWD has regularly needed to purchase the Tier 2 Treated MWD supply (the most expensive source of imported water) because RCWD's Tier 1 allocation was insufficient to meet demand. Tier 2 Treated imported water is therefore considered to be the marginal water source for RCWD. Thus, it can be assumed that the reduced overall potable water demand due to increased water use efficiency and recycled water offsets will result in an equivalent reduction in Tier 2 Treated potable supply purchased by RCWD.

This Project will directly offset 43 AFY of Tier 2 Treated imported water provided by MWD. Fourteen AFY will be offset by water use efficiency improvements such as turf replacement and irrigation hardware upgrades, and 29 AFY will be offset by switching to recycled water supply. Over the assumed 30-year life of all improvements, 1,290 AF of Tier 2 Treated imported water supply will be avoided.

These annual potable water demand estimates are based on water demand at the three HOA sites from 2008 to 2012 (shown below in **Table 8-4**). No other water conservation projects are planned at these sites, so the average of water consumption over these years is used as the standard estimate of water conserved through this project. Since benefits are only estimated over a 30-year benefit lifetime, total benefits are conservative since water conservation will likely continue beyond this 30-year span.

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Table 8-4: Historical Annual Water Consumption at Project Sites (AFY)

Site	2012	2011	2010	2009	2008	Average
Meadowview	15	13	15	15	13	14
Paloma Del Sol	22	15	16	18	14	16
Rainbow Canyon	11	10	12	16	20	13
TOTAL	48	38	43	49	47	43

To calculate the present value of offset imports, the amount of avoided imported water is multiplied by the total cost of Tier 2 Treated water in each year. The total cost of Tier 2 Treated water includes costs for MWD's direct contractors, EMWD and WMWD, which supply imported water from MWD to RCWD.

MWD's Tier 1 supply rate recovers the majority of supply costs, and reflects the cost of existing supplies. The Tier 2 supply rate reflects MWD's cost of developing new long-term firm supplies so that member agencies with increasing demands pay a greater proportion of the cost to develop these additional supplies (RCWD, 2011). Based on planned improvements and projects, we expect that the costs to develop new supplies will cause an annual price escalation (above inflation) in MWD water rates of 3.5% through 2020. After this period, it is assumed that prices will likely rise by 1.5% due to newly developed water supply sources and methods.

Based on these escalation assumptions, MWD's Tier 2 Treated water cost of \$920 in 2012 and \$997 in 2013, and the melded administration charges from EMWD and WMWD of \$10.44, we estimate that offsetting 43 AFY of imported water will provide an estimated benefit of \$39,124 in 2015, the first year in which full project benefits are realized. Accounting for the price escalation of imported water and a standard discount rate of 6%, we estimate the present value of future avoided water imports to amount to \$754,725 over the 30-year project life.

Reduced Social Costs of Carbon

As described in Attachment 7, reduced reliance on imported water will avoid the extensive energy requirements associated with imported water. This in turn will result in avoided CO₂ emissions (a GHG) associated with the production of this energy.

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To calculate avoided CO₂ emissions with the Project, the amount of energy required to treat and convey 43 AF of imported MWD water (3.2 MWh/AF; Navigant Consulting, 2006²) is multiplied by the average carbon emissions rate associated with energy production in California (0.354 MT/MWh). Since EMWD treats all wastewater to tertiary standards at the TVRWRF (the facility from which the three HOA sites will receive all of their recycled water), it is assumed that there are no additional energy requirements associated with treating recycled water with the project compared to the “without project” scenario³.

By avoiding 43 AFY of imported water (at full implementation), the Project will result in a net reduction in CO₂ emissions of 49 metric ton (MT) per year. Given the schedule for project construction (with some benefits beginning to accrue in 2013), total net CO₂ emissions reductions amount to 1,464 MT over the 30-year project life.

To monetize this benefit, we applied the dollar value assigned to greenhouse gas (GHG) emissions, measured in carbon dioxide equivalent (CO₂e). The social cost of carbon is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present (IPCC, 2007). In February 2010, the U.S. Government’s Interagency Working Group on Social Cost of Carbon issued guidance (Interagency Working Group, 2010) on recommended values for the social cost of carbon for use in regulatory benefit-cost analysis. The recommended mean estimate of the social cost of reducing one MT of CO₂ in 2012 is \$22.53/MT(updated from 2010 values using CPI), with a range of values from \$4.95 to \$68.33 per MT. The recommended mean estimate of the social cost of carbon reflects the worldwide net benefits of reducing CO₂ emissions. Estimates of the portions of the net benefits occurring in the United States range from 7% to 23% of the worldwide social cost of carbon.

For this analysis, the average value of \$22.53/MT was used when calculating social benefits and costs, which produces conservative estimates for the benefits and costs associated with GHG emissions. To determine total costs over the 30-year project period, we escalate the social cost

² Although RCWD receives imported water from both the State Water Project (SWP) and the Colorado River, SWP water is the most expensive and energy intensive source of water for MWD to provide. Thus, recycled water is assumed to offset SWP water and estimates for energy use reflect this.

³ In addition, the distribution of 29 AFY of recycled water requires about the same amount of energy as the distribution of 43 AFY of potable water because the TVRWRF is located at a lower elevation than RCWD potable water supplies. Due to the reduced amount of water being distributed with the Project, energy requirements associated with distribution with and without the project are essentially equal (within 2.03 MWh per year). Thus, there will be no avoided energy use associated with local distribution of supplies if this project is implemented.

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of carbon by 2.4% per year⁴, which is above the general rate of inflation. The social cost of carbon will increase in future years because CO₂ will produce larger incremental damages as physical and economic systems become more stressed in responding to greater climate change.

Over the 30-year project life, total present value benefits associated with avoided social costs of carbon amount to \$19,014. **Table 8-5** summarizes the annual benefits from the Project.

⁴ The United Kingdom has established an official estimate of the social cost of carbon for use in many of its project evaluations and models the growth rate of the real cost at 2.4% per year.

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Table 8-5 – Annual Benefit

(All benefits should be in 2012 dollars)

Project: Recycled Water and Plant Material Conversion

Real Escalation Rate Through 2020: 3.5%

Real Escalation Rate After 2020: 1.5%

CO2 Social Cost Escalation Rate: 2.4%

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2013	Avoided Water Imports - WUE	Acre-Feet	0	0.65	0.65	\$1,007	\$656	0.943	\$619
2013	Avoided Water Imports - RW	Acre-Feet	0	1.35	1.35	\$1,007	\$1,359	0.943	\$1,282
2013	Reduced Carbon Emissions	Metric Tons	0	2.3	2.3	\$23	\$51	0.943	\$48
2014	Avoided Water Imports - WUE	Acre-Feet	0	12.80	12.80	\$1,042	\$13,337	0.890	\$11,870
2014	Avoided Water Imports - RW	Acre-Feet	0	26.50	26.50	\$1,042	\$27,627	0.890	\$24,588
2014	Reduced Carbon Emissions	Metric Tons	0	44.6	44.6	\$23	\$1,029	0.890	\$916
2015	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,078	\$15,098	0.840	\$12,677
2015	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,078	\$31,275	0.840	\$26,259
2015	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$24	\$1,153	0.840	\$968
2016	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,116	\$15,622	0.792	\$12,374
2016	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,116	\$32,359	0.792	\$25,631
2016	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$24	\$1,180	0.792	\$935
2017	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,155	\$16,163	0.747	\$12,078
2017	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,155	\$33,481	0.747	\$25,019
2017	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$25	\$1,209	0.747	\$903
2018	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,195	\$16,724	0.705	\$11,790

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Table 8-5 – Annual Benefit									
(All benefits should be in 2012 dollars)									
Project: Recycled Water and Plant Material Conversion									
Real Escalation Rate Through 2020: 3.5%									
Real Escalation Rate After 2020: 1.5%									
CO2 Social Cost Escalation Rate: 2.4%									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2018	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,195	\$34,642	0.705	\$24,421
2018	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$25	\$1,238	0.705	\$873
2019	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,236	\$17,304	0.665	\$11,508
2019	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,236	\$35,844	0.665	\$23,838
2019	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$26	\$1,268	0.665	\$843
2020	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,279	\$17,905	0.627	\$11,234
2020	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,279	\$37,088	0.627	\$23,270
2020	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$27	\$1,298	0.627	\$814
2021	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,287	\$18,025	0.592	\$10,669
2021	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,287	\$37,337	0.592	\$22,100
2021	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$27	\$1,329	0.592	\$787
2022	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,307	\$18,295	0.558	\$10,216
2022	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,307	\$37,897	0.558	\$21,162
2022	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$28	\$1,361	0.558	\$760
2023	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,326	\$18,570	0.527	\$9,782
2023	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,326	\$38,466	0.527	\$20,263
2023	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$29	\$1,394	0.527	\$734
2024	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,346	\$18,848	0.497	\$9,367

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Benefits and Cost Analysis

Table 8-5 – Annual Benefit									
(All benefits should be in 2012 dollars)									
Project: Recycled Water and Plant Material Conversion									
Real Escalation Rate Through 2020: 3.5%									
Real Escalation Rate After 2020: 1.5%									
CO2 Social Cost Escalation Rate: 2.4%									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2024	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,346	\$39,043	0.497	\$19,403
2024	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$29	\$1,427	0.497	\$709
2025	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,366	\$19,131	0.469	\$8,969
2025	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,366	\$39,628	0.469	\$18,579
2025	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$30	\$1,461	0.469	\$685
2026	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,387	\$19,418	0.442	\$8,589
2026	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,387	\$40,223	0.442	\$17,791
2026	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$31	\$1,496	0.442	\$662
2027	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,408	\$19,709	0.417	\$8,224
2027	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,408	\$40,826	0.417	\$17,035
2027	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$31	\$1,532	0.417	\$639
2028	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,429	\$20,005	0.394	\$7,875
2028	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,429	\$41,438	0.394	\$16,312
2028	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$32	\$1,569	0.394	\$618
2029	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,450	\$20,305	0.371	\$7,541
2029	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,450	\$42,060	0.371	\$15,620
2029	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$33	\$1,607	0.371	\$597
2030	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,472	\$20,609	0.350	\$7,220

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Benefits and Cost Analysis

Table 8-5 – Annual Benefit									
(All benefits should be in 2012 dollars)									
Project: Recycled Water and Plant Material Conversion									
Real Escalation Rate Through 2020: 3.5%									
Real Escalation Rate After 2020: 1.5%									
CO2 Social Cost Escalation Rate: 2.4%									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2030	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,472	\$42,691	0.350	\$14,957
2030	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$34	\$1,645	0.350	\$576
2031	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,494	\$20,919	0.331	\$6,914
2031	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,494	\$43,331	0.331	\$14,322
2031	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$35	\$1,685	0.331	\$557
2032	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,517	\$21,232	0.312	\$6,620
2032	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,517	\$43,981	0.312	\$13,714
2032	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$35	\$1,725	0.312	\$538
2033	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,539	\$21,551	0.294	\$6,339
2033	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,539	\$44,641	0.294	\$13,131
2033	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$36	\$1,767	0.294	\$520
2034	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,562	\$21,874	0.278	\$6,070
2034	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,562	\$45,311	0.278	\$12,574
2034	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$37	\$1,809	0.278	\$502
2035	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,586	\$22,202	0.262	\$5,812
2035	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,586	\$45,990	0.262	\$12,040
2035	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$38	\$1,853	0.262	\$485
2036	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,610	\$22,535	0.247	\$5,566

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Benefits and Cost Analysis

Table 8-5 – Annual Benefit									
(All benefits should be in 2012 dollars)									
Project: Recycled Water and Plant Material Conversion									
Real Escalation Rate Through 2020: 3.5%									
Real Escalation Rate After 2020: 1.5%									
CO2 Social Cost Escalation Rate: 2.4%									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2036	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,610	\$46,680	0.247	\$11,529
2036	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$39	\$1,897	0.247	\$469
2037	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,634	\$22,873	0.233	\$5,329
2037	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,634	\$47,380	0.233	\$11,040
2037	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$40	\$1,942	0.233	\$453
2038	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,658	\$23,216	0.220	\$5,103
2038	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,658	\$48,091	0.220	\$10,571
2038	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$41	\$1,989	0.220	\$437
2039	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,683	\$23,565	0.207	\$4,887
2039	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,683	\$48,812	0.207	\$10,122
2039	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$42	\$2,037	0.207	\$422
2040	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,708	\$23,918	0.196	\$4,679
2040	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,708	\$49,545	0.196	\$9,692
2040	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$43	\$2,086	0.196	\$408
2041	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,734	\$24,277	0.185	\$4,480
2041	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,734	\$50,288	0.185	\$9,281
2041	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$44	\$2,136	0.185	\$394
2042	Avoided Water Imports - WUE	Acre-Feet	0	14.00	14.00	\$1,760	\$24,641	0.174	\$4,290

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Benefits and Cost Analysis

Table 8-5 – Annual Benefit									
(All benefits should be in 2012 dollars)									
Project: Recycled Water and Plant Material Conversion									
Real Escalation Rate Through 2020: 3.5%									
Real Escalation Rate After 2020: 1.5%									
CO2 Social Cost Escalation Rate: 2.4%									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2042	Avoided Water Imports - RW	Acre-Feet	0	29.00	29.00	\$1,760	\$51,042	0.174	\$8,887
2042	Reduced Carbon Emissions	Metric Tons	0	48.8	48.8	\$45	\$2,187	0.174	\$381
2043	Avoided Water Imports - WUE	Acre-Feet	0	13.35	13.35	\$1,786	\$23,847	0.164	\$3,917
2043	Avoided Water Imports - RW	Acre-Feet	0	27.65	27.65	\$1,786	\$49,398	0.164	\$8,114
2043	Reduced Carbon Emissions	Metric Tons	0	46.5	46.5	\$46	\$2,135	0.164	\$351
2044	Avoided Water Imports - WUE	Acre-Feet	0	1.20	1.20	\$1,813	\$2,184	0.155	\$338
2044	Avoided Water Imports - RW	Acre-Feet	0	2.50	2.50	\$1,813	\$4,525	0.155	\$701
2044	Reduced Carbon Emissions	Metric Tons	0	4.2	4.2	\$47	\$197	0.155	\$31
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									\$765,209

**Recycled Water and Plant Material Conversion
Project for HOA Common Areas****Benefits and Cost
Analysis****Project Benefits and Costs Summary (Section D5)****Project Economic Costs**

Total project capital costs amount to \$571,757. Direct project administration expenditures account for \$45,309, or roughly 8% of the total project budget. These include project administration, labor compliance, and quarterly and final progress reports. Planning, design, engineering, and environmental documentation costs account for \$82,494, or 14% of the total budget. This includes \$38,253 for initial identification and prioritization of landscape irrigation sites, which occurred in 2009 and is included in our cost analysis (in 2012 dollars). Other project design and permitting costs are incurred between 2012 and 2013. Construction and implementation comprises the bulk of the budget, at \$410,078. The remaining project costs are for construction administration and water district approval expenditures.

In addition to the \$571,757 outlined in the proponent budget, there are additional costs associated with recycled water irrigation systems. Each HOA site is required to pay an extra \$719 for inspections to prevent cross-connectivity while their irrigation system uses recycled water. Each site will incur this fee on an annual basis, for the duration of the project lifetime. These costs are included as operations costs in the annual project cost table.

Table 8-6 summarizes the economic project costs for the project. As shown, total present value costs over the 30-year project life amount to \$568,316.

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Benefits and Cost Analysis

Table 8-6– Annual Costs of Project (All costs should be in 2012 Dollars) Project: Recycled Water and Plant Material Conversion										
	Initial Costs Grand Total Cost from Table 7	Adjusted Grant Total Cost ⁽¹⁾	Annual Costs ⁽²⁾						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs	Discount Factor	Discounted Project Costs
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2009	\$38,253							\$38,253	1.000	\$38,253
2010	\$0							\$0	1.000	\$0
2011	\$0							\$0	1.000	\$0
2012	\$96,075							\$96,075	1.000	\$96,075
2013	\$314,017			\$719				\$314,735	0.943	\$296,920
2014	\$103,914			\$2,156				\$106,070	0.890	\$94,402
2015	\$19,498			\$2,156				\$21,654	0.840	\$18,181
2016				\$2,156				\$2,156	0.792	\$1,707
2017				\$2,156				\$2,156	0.747	\$1,611
2018				\$2,156				\$2,156	0.705	\$1,520
2019				\$2,156				\$2,156	0.665	\$1,434
2020				\$2,156				\$2,156	0.627	\$1,352
2021				\$2,156				\$2,156	0.592	\$1,276
2022				\$2,156				\$2,156	0.558	\$1,204
2023				\$2,156				\$2,156	0.527	\$1,136
2024				\$2,156				\$2,156	0.497	\$1,071
2025				\$2,156				\$2,156	0.469	\$1,011
2026				\$2,156				\$2,156	0.442	\$953
2027				\$2,156				\$2,156	0.417	\$899
2028				\$2,156				\$2,156	0.394	\$849
2029				\$2,156				\$2,156	0.371	\$800

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Benefits and Cost Analysis

Table 8-6– Annual Costs of Project (All costs should be in 2012 Dollars) Project: Recycled Water and Plant Material Conversion										
	Initial Costs Grand Total Cost from Table 7	Adjusted Grant Total Cost ⁽¹⁾	Annual Costs ⁽²⁾						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs	Discount Factor	Discounted Project Costs
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2030				\$2,156				\$2,156	0.350	\$755
2031				\$2,156				\$2,156	0.331	\$712
2032				\$2,156				\$2,156	0.312	\$672
2033				\$2,156				\$2,156	0.294	\$634
2034				\$2,156				\$2,156	0.278	\$598
2035				\$2,156				\$2,156	0.262	\$564
2036				\$2,156				\$2,156	0.247	\$532
2037				\$2,156				\$2,156	0.233	\$502
2038				\$2,156				\$2,156	0.220	\$474
2039				\$2,156				\$2,156	0.207	\$447
2040				\$2,156				\$2,156	0.196	\$422
2041				\$2,156				\$2,156	0.185	\$398
2042				\$2,156				\$2,156	0.174	\$375
2043				\$2,156				\$2,156	0.164	\$354
2044				\$1,437				\$1,437	0.155	\$223
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										\$568,316
Comments: (1) If any, based on opportunity costs, sunk costs and associated costs (2) The incremental change in O&M costs attributable to the project: On-site inspections to prevent cross-connectivity										

**Recycled Water and Plant Material Conversion
Project for HOA Common Areas****Benefits and Cost
Analysis**

Summary

Benefits and costs discussed in this analysis are for all three HOA sites. The Rainbow Canyon HOA site is expected to finish construction, and therefore begin realizing benefits, beginning in 2013. While grant money would expand this program to two additional sites, administrative and other costs are considered combined for all three sites, as are contributing funds from the HOAs. Additionally, certain aspects of the program that apply to all three sites, such as public outreach, development of project monitoring and progress reports, and water district approval costs, are dependent upon grant money.

The present value capital costs, which are distributed between November 30, 2009 and July 31, 2015, amount to \$568,316. The present value of all benefits, as described above, is \$765,209. This yields a present value of net benefits of \$196,893 over the expected 30-year project life.

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In this analysis, the main uncertainties are associated with the avoided cost of importing MWD water and fertilizer cost savings. These issues are listed in **Table 8-7**.

Recycled Water and Plant Material Conversion Project for HOA Common Areas

Benefits and Cost Analysis

Table 8-7. Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided imported water costs	+	Water conserved and converted to RCWD's recycled water system is considered over an assumed 30-year span. Since benefits from turf replacement and the recycled water system are likely to extend beyond 2044, actual avoided costs of imported water will be higher.
Avoided imported water costs	U	The calculation of avoided imported water costs assumes that MWD water rates will increase annually (in real terms) by 3.5% through 2020. Beyond 2020, a 1% real increase in water rates is assumed. These projections are based on existing and planned MWD financial commitments and recent increases in MWD rates. It is uncertain whether actual future rate increases will be above or below these assumed rate increases.
Avoided social costs of carbon	U	The estimate used for the social costs of CO ₂ emissions represents the mid-point estimate of values from the existing literature. The true social costs associated with CO ₂ emissions could be higher or lower.

*Direction and magnitude of effect on net benefits:

+ = Likely to increase net benefits relative to quantified estimates.

++ = Likely to increase net benefits significantly.

– = Likely to decrease benefits.

– – = Likely to decrease net benefits significantly.

U = Uncertain, could be + or –.

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Native Botanical Garden Project

Introduction

This attachment presents the economic analysis for the South Coast Resource Conservation and Development Council's (SCRC&DC) Native Botanical Garden Project. The Native Botanical Garden project directly benefits the Anza Valley area, which is a recognized disadvantaged community (DAC), and costs less than \$300,000 to implement. Therefore, a cost-effectiveness analysis was completed for the project pursuant to guidance provided in DWR's Proposition 84 Integrated Regional Water Management (IRWM) Implementation Grant Proposal Solicitation Package (PSP).

The following sections provide a brief description of the project, followed by sections outlined in the PSP for Attachment 8, including: cost-effectiveness analysis (Section D1) and a summary of the project costs and benefits (Section D5). Because a cost-effectiveness analysis was performed and this project does not result in any avoided flood damages, there is no need for Sections D2 (Non-Monetized Benefits Analysis), D3 (Monetized Benefits Analysis), or D4 (Flood Damage Reduction Benefits Analysis) in this attachment. However, as part of the cost-effectiveness analysis, the benefits of the project are described in detail below.

Project Description

The Native Botanical Garden Project is proposed by the SCRC&DC in partnership with the Hamilton Museum, the High Country Conservancy, and the Anza Community Beautification and Garden Projects Committee. The Native Botanical Garden Project would expand an existing native plant garden at the Hamilton Museum by an additional ½ acre. The additional native botanical garden will re-vegetate the existing open space with exhibit plants that represent the local landscape and natural habitat types unique to the Anza Valley. To access the plant exhibits, a series of winding pathways will be constructed throughout the Project site garden. Each of the plant exhibits will have interpretive signs and plant identification markers installed to assist the public with selecting plant varieties to use in their own gardens and landscaping designs. The proposed Project would also install viewing benches and a covered area throughout the garden for people to sit and gather during public workshops.

The Native Botanical Garden Project seeks to improve water conservation regionally by educating and encouraging property owners to use native plants in their landscape in lieu of invasive plants that require more irrigation water to survive. Public workshops and tours will discuss the habitat, water supply and water quality benefits of restoring native plants to the

Native Botanical Garden Project**Benefits and Cost
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Region. In this way, the Native Botanical Garden would be used as an educational outreach facility to demonstrate to the public the natural beauty of native landscapes and how using drought-tolerant native plant species can help conserve water resources while enhancing the aesthetics and resource-value of the local living environment.

As an added benefit, the Native Botanical Garden Project will provide an opportunity to enhance relationships between community members and local organizations working for the benefit of the community by providing a shared community recreation area.

Although activities associated with this project, including tours and workshops, will be completed within 2 years, it is anticipated that additional educational and community activities will be implemented at the garden for at least a 15-year project life, and beyond.

Summary of Benefits and Costs

This project will result in quantified benefits of approximately 60 AF of potential groundwater savings over the 15-year project life. This benefit is dependent on the number of people that switch to low water use landscapes due to education provided through the garden, at workshops and tours, or through associated outreach efforts. Because this project will serve a DAC, a cost-effectiveness analysis was performed as described in the following section, and there are no monetized benefits associated with this project.

Table 8-8 provides an overview of the costs and non-monetized benefits associated with the project.

Native Botanical Garden Project

Benefits and Cost
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Table 8-8. Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	\$170,801
<i>Physically Quantified Benefit or Cost</i>	Project Life Total
Water Supply	60 AF
Recreation	0.5 acre
Habitat	0.5 acre
<i>Qualitative Benefit or Cost</i>	Qualitative Indicator*
Public Education	++
Energy Savings and Reduced CO2 emissions	+
Improved Water Quality	+
<p>* Direction and magnitude of effect on net benefits:</p> <p>+ = Likely to increase net benefits relative to quantified estimates.</p> <p>++ = Likely to increase net benefits significantly.</p> <p>– = Likely to decrease net benefits.</p> <p>– – = Likely to decrease net benefits significantly.</p> <p>U = Uncertain, could be + or –.</p>	

Cost-Effectiveness Analysis (Section D1)

The Project will provide the following quantified benefits as described in Attachment 7:

- Water Supply – increase groundwater supply through water use efficiency
- Recreation - increase and enhance recreational space for DAC area
- Habitat – create native plant ecosystems that improve local habitat

The Project will also provide the Anza Valley with the following qualitative benefits:

- Public education
- Energy savings and reduced CO2 emissions
- Improved water quality

Water Supply Benefit

The primary benefit of the Project is to increase irrigation water use efficiency, thereby decreasing demand for local groundwater throughout the Anza Valley area.

Native Botanical Garden Project**Benefits and Cost
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In addition to providing information on low-water use plants native to the Anza Valley, the Project will educate the public about appropriate soil preparation and irrigation methods and protocols that will provide the appropriate moisture levels for native plants. This will decrease irrigation demand and increase the availability of groundwater supplies for higher use. Since the Anza Valley is considered a DAC with a low population density, educational and partnership-building activities aimed at protecting local natural resources are needed in order to promote an integrated, effective approach to valley-wide awareness and stewardship. The Project could result in 4 AFY and 60 AF over the course of the 15-year Project life. The process used to quantify this benefit is described in Attachment 7.

Recreation Benefit

The proposed project would result in an additional 1/2 acre of garden for public use. The garden would be used for education, but would also provide an aesthetically pleasing setting for passive recreation opportunities and a location for community events. The 1/2 acre space will provide walking pathways and other features to allow for enjoyment of the open space.

Habitat Benefit

The re-vegetation of the project site with native plant species will help further enhance the Anza Valley area by creating habitat areas that have been lost to development and agriculture. Education provided at the garden will also encourage the use of native plants in local landscapes. The Project will re-vegetate the majority of the area but will also preserve and educate about an important species to the Anza Valley area that is currently on the Project site - the redshank tree (*Adenostoma sparsifolium*). The redshank is an important source of both food and water to small mammals including bush rabbits, and the western fence lizard.

Public Education Benefit

The Project includes workshops and tours that will provide opportunities for youth and adults to learn about pro-active resource management so that they can become better stewards of their own land and help educate and encourage others to do the same. The goal for overall attendance at the garden workshops is 100 youths and 100 adults over two years (2014 through 2015). The goal for overall attendance for the garden tours is 200 people.

Energy Savings and Reduced CO2 Emissions Benefit

As a result of reduced demand for local groundwater associated with reduced irrigation needs, this project will result in energy savings due to reduced groundwater pumping. This in turn will result in reduced CO2 emissions and other greenhouse gases (GHGs) associated with this energy production.

Native Botanical Garden Project

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Water Quality Benefit

The education in appropriate soil amendments and fertilization techniques would reduce the over-use of fertilizers and result in less non-point source pollution from gardens. The adult land-stewardship classes would include the application of principles of non-point source pollution control, manure/animal waste management, and household/farm hazardous waste disposal.

Many properties in the Anza Valley are have limited vegetation cover due to land owners clearing acreage for fire prevention which leaves the land vulnerable to water erosion which contributes to increased sediment loads in nearby streams and creeks. Educating the community on the wise use of native fire-resistant plants as an alternative to completely clearing property could result in the implementation of these ideas by land-owners, helping to improve water quality.

Cost Effectiveness Analysis

Responses to questions outlined in the cost-effectiveness analysis guidance of the PSP are summarized in **Table 8-9**.

Table 8-9: Statement of Cost Effectiveness

Native Botanical Garden Project	
Types of Benefits Provided	<ul style="list-style-type: none"> • Water Supply • Recreation • Habitat • Public education • Energy savings and reduced CO2 emissions • Improved water quality
Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? If no, why?	No, no other alternatives will provide the same level of benefits at a reasonable cost. The proposed garden site provides a hands-on outdoor learning experience that maximizes the resources of the existing museum and related infrastructure on-site.
If yes, list the methods (including the proposed project) and estimated costs	Not Applicable
If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of an accomplishment of the proposed project that is different from the alternative project or methods.	Not Applicable

Native Botanical Garden ProjectBenefits and Cost
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Total capital/implementation costs of the project equal \$173,809 (undiscounted). Capital costs include Direct Administration Costs of \$11,690, Planning/Design/Engineering/Environmental Documentation costs of \$16,600, Construction Implementation Costs of \$105,047, Construction Administration costs of \$34,000 and construction contingency costs of \$6,472.

In addition, the garden will be maintained by volunteers over the 15-year project life. It is estimated that maintenance will require 8 hours of volunteer time per month once the garden is completed. To calculate O&M costs for this grant application, we assumed an average value of volunteer time of \$21.79 per hour. Based on this assumption, total maintenance costs will amount to about \$2,092 per year.

Based on these assumptions, total present value costs of the project amount to \$170,801 over the 15-year project life. Present value costs were calculated based on an implementation period of 24 months - 3 months in 2013, 12 months in 2014, 9 months in 2015. Maintenance costs are expected to begin in mid-2014 and continue through 2028 (the last year of the project life). **Table 8-10** summarizes the project life-cycle costs.

Native Botanical Garden Project

Benefits and Cost Analysis

Table 8-10 – Annual Costs of Project (All costs should be in 2012 Dollars)										
	Initial Costs Grand Total Cost from Table 7	Adjusted Grant Total Cost ⁽¹⁾	Annual Costs ⁽²⁾						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs	Discount Factor	Discounted Project Costs
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012									1.000	N/A
2013	\$21,726							\$ 21,726	0.943	\$20,496
2014	\$86,904				\$1,046			\$ 87,950	0.890	\$78,275
2015	\$65,178				\$2,092			\$ 67,270	0.840	\$56,481
2016					\$2,092			\$ 2,092	0.792	\$1,657
2017					\$2,092			\$ 2,092	0.747	\$1,563
2018					\$2,092			\$ 2,092	0.705	\$1,475
2019					\$2,092			\$ 2,092	0.665	\$1,391
2020					\$2,092			\$ 2,092	0.627	\$1,312
2021					\$2,092			\$ 2,092	0.592	\$1,238
2022					\$2,092			\$ 2,092	0.558	\$1,168
2023					\$2,092			\$ 2,092	0.527	\$1,102
2024					\$2,092			\$ 2,092	0.497	\$1,040
2025					\$2,092			\$ 2,092	0.469	\$981
2026					\$2,092			\$ 2,092	0.442	\$925
2027					\$2,092			\$ 2,092	0.417	\$873
2028					\$2,092			\$ 2,092	0.394	\$823
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										\$170,801
Comments: (1) If any, based on opportunity costs, sunk costs and associated costs. (2) The incremental change in O&M costs attributable to the project: On-site inspections to prevent cross-connectivity										

Upper Valle de Los Caballos Recharge Project

Introduction

This attachment presents the economic analysis for a portion of the Upper Valle de Los Caballos Recharge/Recovery Facility Conjunctive Use Optimization Project. A project abstract and project benefit summary table are followed by sections outlined in Exhibit D of the Integrated Regional Water Management Proposition 84 Implementation Round 2 Proposal Solicitation Package(PSP) for Attachment 8, including: Non-Monetized Benefits Analysis (Section D2), Monetized Benefit Analysis (Section D3), and Project Benefits and Costs Summary (Section D5). This project does not serve a disadvantaged community and does not provide flood control benefits. PSP Sections D1 (Cost-Effectiveness Analysis) and D4 (Flood Damage Reduction Benefits Analysis) are therefore not included in this attachment.

Project Abstract

RCWD currently obtains more than 50% of its water supplies from MWD. The water obtained from MWD comes in two forms: treated and untreated. Treated water can be delivered directly to customers, while the untreated water is not yet compliant with the California Department of Public Health (CDPH) requirements for potable use. RCWD currently purchases about 12,000 AFY of untreated water from MWD (via connected capacity agreements through Eastern and Western Municipal Water Districts).

With the proposed project, RCWD plans to increase its purchase of untreated water from MWD for groundwater recharge. This water will be placed into a spreading basin (the Upper Valle de Los Caballos Recharge Recovery Facility) and infiltrate the supply of water into the underlying groundwater basin. All this water will later be pumped out via recovery wells, treated to drinking water standards of the CDPH, and distributed for potable use. The recharged water placed into the spreading basin will be recovered from wells located both at the VDCR/RF and downgradient wells located within the Pauba Valley westerly of the VDCR/RF.

RCWD plans to increase the amount of untreated imported water for recharge it obtains from MWD because this water is less expensive than treated water from MWD, and it has capacity to increase its untreated water deliveries with its 80 cfs EM-21 turn-out with MWD and conveyance system that delivers the untreated water to the VDCR/RF. Towards this end, RCWD wishes to acquire grant funding for the creation of a new recovery well (Well 161) at the VDCR/RF. Provided that RCWD puts more water into the spreading basins at the VDCR/RF, a new recovery well will allow RCWD to pump more water out of the spreading basin, thus saving

Upper Valle de Los Caballos Recharge Project

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RCWD additional money over and above its current operations. Thus, this project will increase water supply reliability with the opportunity to manage the additional groundwater recharge and storage relationships.

In addition to the recovery well, this project includes berm and grading work, electrical and instrumentation work, and the construction of pond discharge structures, a raw water pipeline, and a treated water pipeline. These components of the project will facilitate additional infiltration at the VDCR/RF. However, only a portion of these facilities are necessary for delivery of additional untreated water for recharge of the one recovery well being constructed under this project. Because of this, only a portion of these facilities' costs will be assigned to this project (this apportionment is discussed in detail in the Project Economic Costs section below).

Summary Project Benefits and Costs

A summary of all benefits and costs of the project are provided in **Table 8-11**. Monetized benefits and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Table 8-11. Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	\$15,795,549
Monetizable Benefits	
Avoided Water Supply Costs(due to importing untreated versus treated)	\$24,923,501
Total Monetizable Benefits	\$24,923,501
Physically Quantifiable Benefits	
Local Groundwater Recharge	5,417 AFY
Non-monetizable Benefits	Qualitative Indicator*
Improve Water Quality in the Aquifer	+
Improve Water Supply Reliability	++
Maximize Utilization of Resources	+

* Direction and magnitude of effect on net benefits:

+ = Likely to increase net benefits relative to quantified estimates.

++ = Likely to increase net benefits significantly.

– = Likely to decrease net benefits.

— = Likely to decrease net benefits significantly.

U = Uncertain, could be + or –.

Upper Valle de Los Caballos Recharge Project

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Non-Monetized Benefits Analysis (Section D2)

Table 8-12 shows the non-monetized benefits checklist for the project. Narrative descriptions of the benefit categories marked “Yes” in the following table are provided in the narrative description of qualitative benefits section after the table.

Table 8-12 (PSP Table 12) Upper Valle de Los Caballos Recharge/Recovery Facility Conjunctive Use Optimization Project Non-monetized Benefits Checklist		
	Community/Social Benefits: Will the proposal	
1	Provide education or technology benefits?	No
2	Provide social recreation or access benefits?	No
3	Help avoid, reduce or resolve various public water resources conflicts?	No
4	Promote social health and safety?	No
5	Have other social benefits?	No
	Environmental Stewardship Benefits: Will the proposal	
6	Benefit wildlife or habitat in ways that were not quantified in Attachment 7?	No
7	Improve water quality in ways that were not quantified in Attachment 7?	Yes
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3 or D4?	No
	Sustainability Benefits: Will the proposal	
10	Improve the overall, long-term management of California groundwater resources?	No ¹
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?	No
14	Improve water supply reliability in ways not quantified in Attachment 7?	Yes
15	Other: Increased utilization of resources	Yes

¹ This benefit category is marked as no because it was already described as a physically quantified benefit in Attachment 7.

Narrative Description of Qualitative Benefits

Improve Water Quality in Ways that Were not Quantified in Attachment 7: Improve Water Quality in the Aquifer

Untreated imported water that will be placed into the spreading basins of the VDCR/RF will have a lower salt concentration than the agricultural drainage water and other degraded water sources that currently filter into the aquifer. As the untreated imported water infiltrates into the aquifer, it will dilute the higher salt concentrations from the degraded water sources, improving overall water quality.

Improve Water Supply Reliability: Maximize Local Basin Storage Potential

The installation of a new recovery well at the VDCR/RF will improve RCWD's water supply reliability by increasing the amount of supply that can be stored in the local groundwater basin. Local storage allows RCWD to take advantage of the untreated imported water supply when it is available, and reduces dependence on the treated imported water supply during peak demand periods. Local storage also provides RCWD with a greater ability to obtain water when it needs it. Specifically, with this project, water can be placed into the spreading basins throughout the year and then pumped out at the VDCR/RF and downgradient wells when the demand is sufficiently high. This differs from the current situation where RCWD relies upon MWD to supply treated water, which may not always be available even if RCWD's customers are demanding it.

In addition, the reliability of RCWD's imported water supply from MWD has been and will continue to be vulnerable to a number of natural and human forces, including: transmission interruption from earthquakes, increasing municipal demands, limited and potentially decreasing snow pack and Bay-Delta flows (due to climate change), Bay-Delta ecosystem issues (and associated regulations), and water rights determinations. By storing untreated water throughout the year through groundwater recharge, RCWD can offset the impact of MWD not being able to deliver imported water at a specific point in time.

Other: Maximize Utilization of Existing Facilities

This project will utilize natural and man-made resources that RCWD is not currently using to their full potential including the spreading basin, aquifer, and down-gradient wells (as mentioned in the Project Abstract, the down-gradient wells are used for pumping a portion of the water originally placed into the spreading basin). Each of these resources will be used in this project to produce water for RCWD's customers through the VDCR/RF.

Monetized Benefit Analysis (Section D3)

One monetized benefit is expected to accrue over the expected 50-year life of the project. This benefit results from the cost difference between treated and untreated MWD water.

Avoided Water Supply Costs (due to importing untreated as opposed to treated water)

The new recovery well is expected to produce 4.5 cubic feet per second, or 3,250 AFY. Historically, about 60% of the water placed into the spreading basin can be directly recovered by the recovery wells located in Upper VDC area.⁵ Thus, in order to produce 3,250 AFY, about 5,417 AFY will need to be placed into the spreading basin. The 5,417 acre-feet placed into the spreading basin will be Tier 2 *untreated* water from MWD.

In addition to the water produced from the new recovery well, RCWD expects to obtain the remaining 40% of the water, or 2,167 AFY, that it cannot recover directly from the VDCR/RF from existing RCWD wells located downgradient. Once pumped out of the ground, this water can be treated and then delivered to customers. Thus, of the 5,417 AFY placed into the spreading basin, all 5,417 AFY (3,250 acre-feet plus 2,167 acre-feet) will ultimately be used by RCWD's customers. The water generated from this project will be available for use by all of RCWD's customers, not just a particular class of water users.

The 5,417 acre-feet of water produced each year by this project will allow RCWD to purchase 5,417 acre-feet less of Tier 2 *treated* water from MWD. Since untreated water is less expensive than treated water, this project reduces costs associated with MWD water purchases. In 2013, the cost of untreated MWD water for RCWD amounted to \$753 per acre-foot (in 2012 USD) while the cost of treated water was \$1,007 per acre-foot (2012 USD)⁶. These costs include the cost of the water itself and a \$10.44 charge per acre-foot for wholesale administration costs that are directly related to importing water.⁷

In addition, in recent years, annual MWD rate increases have averaged about 6% in nominal terms (i.e., including inflation). For this analysis, we assume that the cost of imported supplies will continue to increase at this rate through 2020 due to current and planned MWD financial

⁵ Attachment #3 states, "Since 1999, RCWD has recharged an average of approximately 20.4 cfs of imported water in the five Upper VDC ponds. Over that same period, an average of approximately 12.0 cfs has been recovered from the four Upper VDC wells, equivalent to approximately 60 percent of the total water released."

⁶ Cost information for Tier 2 untreated and treated MWD water comes from MWD:

http://www.mwdh2o.com/mwdh2o/pages/finance/finance_03.html

⁷ The current average cost per acre-foot of water from Eastern and Western Municipal Water Districts.

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commitments. After adjusting for projected annual inflation of about 2.3%⁸, the cost of imported water is therefore expected to increase annually by 3.5% or more in real terms over this time period. Beginning in 2021, a 1.5% annual real increase in water rates is assumed through the end of the Project life. **Appendix F** provides additional documentation on the escalation rates for imported water costs assumed for this analysis.

To calculate cost savings over the project life, 5,417 acre-feet is multiplied by the cost difference between untreated and treated water in each year. Based on the schedule for project implementation, costs savings will start occurring in 2018, the year RCWD will begin to operate the recovery well. Benefits will continue to accrue over the 50-year project life, through 2067.

The cost difference between untreated and treated water increases over time: in 2018, the cost difference is \$302 per acre-foot, yet by 2067 the cost difference is \$651 (this increase in the cost difference is because a given rate escalation of both a larger and smaller number causes a bigger absolute change in the larger number).

The present value of the benefit over the 50 year expected useful life of the project is \$24,923,501. **Table 8-13** summarizes the annual monetized benefit from the project.

⁸ Based on long-range Consumer Price Index (CPI) projections from the Federal Reserve Bank of Philadelphia of 2.3% per year, for 2013 through 2022.

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Benefits and Cost Analysis

Table 8-13 – Annual Benefit
(All benefits should be in 2012 dollars)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2012								1.000	\$0
2013								0.943	\$0
2014								0.890	\$0
2015								0.840	\$0
2016								0.792	\$0
2017								0.747	\$0
2018	Water Supply	Acre-feet	0	5,417	5,417	\$302	\$1,634,159	0.705	\$1,152,018
2019	Water Supply	Acre-feet	0	5,417	5,417	\$312	\$1,691,355	0.665	\$1,124,847
2020	Water Supply	Acre-feet	0	5,417	5,417	\$323	\$1,750,552	0.627	\$1,098,318
2021	Water Supply	Acre-feet	0	5,417	5,417	\$328	\$1,776,810	0.592	\$1,051,691
2022	Water Supply	Acre-feet	0	5,417	5,417	\$333	\$1,803,462	0.558	\$1,007,044
2023	Water Supply	Acre-feet	0	5,417	5,417	\$338	\$1,830,514	0.527	\$964,292
2024	Water Supply	Acre-feet	0	5,417	5,417	\$343	\$1,857,972	0.497	\$923,355
2025	Water Supply	Acre-feet	0	5,417	5,417	\$348	\$1,885,842	0.469	\$884,156
2026	Water Supply	Acre-feet	0	5,417	5,417	\$353	\$1,914,129	0.442	\$846,621
2027	Water Supply	Acre-feet	0	5,417	5,417	\$359	\$1,942,841	0.417	\$810,680
2028	Water Supply	Acre-feet	0	5,417	5,417	\$364	\$1,971,984	0.394	\$776,264
2029	Water Supply	Acre-feet	0	5,417	5,417	\$369	\$2,001,564	0.371	\$743,309
2030	Water Supply	Acre-feet	0	5,417	5,417	\$375	\$2,031,587	0.350	\$711,754
2031	Water Supply	Acre-feet	0	5,417	5,417	\$381	\$2,062,061	0.331	\$681,538
2032	Water Supply	Acre-feet	0	5,417	5,417	\$386	\$2,092,992	0.312	\$652,605
2033	Water Supply	Acre-feet	0	5,417	5,417	\$392	\$2,124,387	0.294	\$624,900

Upper Valle de Los Caballos Recharge Project

Benefits and Cost Analysis

Table 8-13 – Annual Benefit (All benefits should be in 2012 dollars)									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2034	Water Supply	Acre-feet	0	5,417	5,417	\$398	\$2,156,252	0.278	\$598,371
2035	Water Supply	Acre-feet	0	5,417	5,417	\$404	\$2,188,596	0.262	\$572,968
2036	Water Supply	Acre-feet	0	5,417	5,417	\$410	\$2,221,425	0.247	\$548,644
2037	Water Supply	Acre-feet	0	5,417	5,417	\$416	\$2,254,746	0.233	\$525,353
2038	Water Supply	Acre-feet	0	5,417	5,417	\$422	\$2,288,568	0.220	\$503,050
2039	Water Supply	Acre-feet	0	5,417	5,417	\$429	\$2,322,896	0.207	\$481,694
2040	Water Supply	Acre-feet	0	5,417	5,417	\$435	\$2,357,740	0.196	\$461,245
2041	Water Supply	Acre-feet	0	5,417	5,417	\$442	\$2,393,106	0.185	\$441,664
2042	Water Supply	Acre-feet	0	5,417	5,417	\$448	\$2,429,002	0.174	\$422,914
2043	Water Supply	Acre-feet	0	5,417	5,417	\$455	\$2,465,437	0.164	\$404,960
2044	Water Supply	Acre-feet	0	5,417	5,417	\$462	\$2,502,419	0.155	\$387,768
2045	Water Supply	Acre-feet	0	5,417	5,417	\$469	\$2,539,955	0.146	\$371,306
2046	Water Supply	Acre-feet	0	5,417	5,417	\$476	\$2,578,055	0.138	\$355,543
2047	Water Supply	Acre-feet	0	5,417	5,417	\$483	\$2,616,725	0.130	\$340,450
2048	Water Supply	Acre-feet	0	5,417	5,417	\$490	\$2,655,976	0.123	\$325,997
2049	Water Supply	Acre-feet	0	5,417	5,417	\$498	\$2,695,816	0.116	\$312,157
2050	Water Supply	Acre-feet	0	5,417	5,417	\$505	\$2,736,253	0.109	\$298,905
2051	Water Supply	Acre-feet	0	5,417	5,417	\$513	\$2,777,297	0.103	\$286,216
2052	Water Supply	Acre-feet	0	5,417	5,417	\$520	\$2,818,956	0.097	\$274,065
2053	Water Supply	Acre-feet	0	5,417	5,417	\$528	\$2,861,241	0.092	\$262,430
2054	Water Supply	Acre-feet	0	5,417	5,417	\$536	\$2,904,159	0.087	\$251,289
2055	Water Supply	Acre-feet	0	5,417	5,417	\$544	\$2,947,722	0.082	\$240,621
2056	Water Supply	Acre-feet	0	5,417	5,417	\$552	\$2,991,938	0.077	\$230,406
2057	Water Supply	Acre-feet	0	5,417	5,417	\$561	\$3,036,817	0.073	\$220,625

Upper Valle de Los Caballos Recharge Project

Benefits and Cost Analysis

Table 8-13 – Annual Benefit (All benefits should be in 2012 dollars)									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project	Unit \$ Value ⁽¹⁾	Annual \$ Value ⁽¹⁾	Discount Factor ⁽¹⁾	Discounted Benefits ⁽¹⁾
2058	Water Supply	Acre-feet	0	5,417	5,417	\$569	\$3,082,369	0.069	\$211,259
2059	Water Supply	Acre-feet	0	5,417	5,417	\$578	\$3,128,604	0.065	\$202,290
2060	Water Supply	Acre-feet	0	5,417	5,417	\$586	\$3,175,533	0.061	\$193,702
2061	Water Supply	Acre-feet	0	5,417	5,417	\$595	\$3,223,166	0.058	\$185,479
2062	Water Supply	Acre-feet	0	5,417	5,417	\$604	\$3,271,514	0.054	\$177,605
2063	Water Supply	Acre-feet	0	5,417	5,417	\$613	\$3,320,587	0.051	\$170,065
2064	Water Supply	Acre-feet	0	5,417	5,417	\$622	\$3,370,395	0.048	\$162,846
2065	Water Supply	Acre-feet	0	5,417	5,417	\$632	\$3,420,951	0.046	\$155,932
2066	Water Supply	Acre-feet	0	5,417	5,417	\$641	\$3,472,266	0.043	\$149,313
2067	Water Supply	Acre-feet	0	5,417	5,417	\$651	\$3,524,350	0.041	\$142,974
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									\$24,923,501
Comments: With the project, the Rancho California Water District will purchase 5,417 acre-feet of untreated MWD water each year. In comparison, without the project, the Rancho California Water District would purchase 5,417 acre-feet of treated MWD water each year. Thus, the annual benefit realized is 5,417 acre-feet of water multiplied by the difference in costs between treated and untreated MWD water. Benefits start to accrue in 2018, the first year RCWD will operate the recovery well.									

Project Benefits and Costs Summary (Section D5)

Project Economic Costs

Capital costs associated with this project include the cost to build a new recovery well and treated water pipeline at the VDCR/RF. The new recovery well and treated water pipeline will be used to generate the benefits described in this attachment.

In addition to the costs of constructing a new recovery well and treated water pipeline, there are other capital costs associated with the project that will be used in capacities outside of this project (and will generate additional benefits not described here). These costs are associated with modifying existing berms and grading, constructing pond discharge structures, Well 161 discharge pipeline, and a raw water pipeline, and electrical equipment and instrumentation. It is believed that these items will be used for at least six other planned recovery wells at the VDCR/RF, in addition to this project's recovery well. Thus, only 14% (one divided by seven) of the costs for these items are attributed to this project.

Due to the production of water in the two different fashions (from the VDCR/RF and from the downgradient wells as discussed in the Monetized Benefit Analysis section), this project will have two sets of operations and maintenance (O&M) costs. The two sets of O&M costs include:

- (1) The costs of importing 5,417 AFY of untreated imported water, placing this water into the VDCR/RF spreading basin, pumping 3,250 AFY out of the spreading basin via the new recovery well, and then treating this water so that it can be delivered to customers.
- (2) The costs of pumping and treating 2,167 AFY from the wells located downgradient of the VDCR/RF.

Instead of using two different O&M costs, a single cost can be developed as a blended rate. The blended rate is \$180 per acre-foot for O&M. Of the \$180 per acre-foot, \$18 is for administration (10%), \$131 is for operations (73%), and \$31 is for maintenance (17%). There are not any "replacement" costs, as these are included in the capital costs.

The total present value cost for the entire project, including both capital and O&M costs, is \$15,795,549. **Table 8-14** summarizes the economic project costs for the project.

Upper Valle de Los Caballos Recharge Project

Benefits and Cost Analysis

Table 8-14 – Annual Costs of Project										
(All costs should be in 2012 Dollars)										
	Initial Costs Grand Total Cost from Table 7	Adjusted Grant Total Cost ⁽¹⁾	Annual Costs ⁽²⁾						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs	Discount Factor	Discounted Project Costs
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2010	\$0							\$0	1.000	\$0
2011	\$0							\$0	1.000	\$0
2012	\$0							\$0	1.000	\$0
2013	\$ 463,916							\$463,916	0.943	\$437,656
2014	\$190,631							\$190,631	0.890	\$169,661
2015	\$197,639							\$197,639	0.840	\$165,941
2016	\$1,447,936							\$1,447,936	0.792	\$1,146,901
2017	\$2,277,515		\$97,506	\$711,794	\$165,760			\$3,252,575	0.747	\$2,430,513
2018	\$0		\$97,506	\$711,794	\$165,760			\$975,060	0.705	\$687,379
2019	\$0		\$97,506	\$711,794	\$165,760			\$975,060	0.665	\$648,471
2020	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.627	\$611,765
2021	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.592	\$577,137
2022	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.558	\$544,468
2023	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.527	\$513,649
2024	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.497	\$484,575
2025	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.469	\$457,146
2026	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.442	\$431,270
2027	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.417	\$406,858
2028	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.394	\$383,829
2029	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.371	\$362,103
2030	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.350	\$341,606
2031	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.331	\$322,270
2032	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.312	\$304,028
2033	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.294	\$286,819

Upper Valle de Los Caballos Recharge Project

Benefits and Cost Analysis

Table 8-14 – Annual Costs of Project										
(All costs should be in 2012 Dollars)										
	Initial Costs Grand Total Cost from Table 7	Adjusted Grant Total Cost ⁽¹⁾	Annual Costs ⁽²⁾						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs	Discount Factor	Discounted Project Costs
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2034	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.278	\$270,584
2035	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.262	\$255,268
2036	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.247	\$240,819
2037	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.233	\$227,188
2038	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.220	\$214,328
2039	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.207	\$202,196
2040	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.196	\$190,751
2041	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.185	\$179,954
2042	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.174	\$169,768
2043	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.164	\$160,158
2044	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.155	\$151,093
2045	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.146	\$142,540
2046	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.138	\$134,472
2047	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.130	\$126,860
2048	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.123	\$119,680
2049	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.116	\$112,905
2050	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.109	\$106,514
2051	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.103	\$100,485
2052	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.097	\$94,797
2053	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.092	\$89,432
2054	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.087	\$84,369
2055	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.082	\$79,594
2056	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.077	\$75,088
2057	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.073	\$70,838

Upper Valle de Los Caballos Recharge Project

Benefits and Cost Analysis

Table 8-14 – Annual Costs of Project

(All costs should be in 2012 Dollars)

	Initial Costs Grand Total Cost from Table 7	Adjusted Grant Total Cost ⁽¹⁾	Annual Costs ⁽²⁾						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs	Discount Factor	Discounted Project Costs
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2058	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.069	\$66,828
2059	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.065	\$63,046
2060	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.061	\$59,477
2061	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.058	\$56,110
2062	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.054	\$52,934
2063	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.051	\$49,938
2064	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.048	\$47,111
2065	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.046	\$44,445
2066	\$ -		\$97,506	\$711,794	\$165,760			\$975,060	0.043	\$ 41,929
Total	\$4,577,637	\$0	\$4,875,300	\$35,589,690	\$8,288,010		\$0	\$53,330,637		\$15,795,549
Total Present Value of Discounted Costs (Sum of Column (j))										
Transfer to Table 17, column (c), Proposal Benefits and Costs Summaries										\$15,795,549
<p>Comments: Initial costs include the costs of the new recovery well, treated water pipeline, berms and grading, pond discharge structures, raw water pipeline, and electrical and instrumentation costs. There are two sets of O&M costs:</p> <p>(1) The costs of importing 5,417 acre-feet per year of untreated imported water, placing this water into the spreading basin, pumping 3,250 acre-feet per year out of the spreading basin via the new recovery well, and then treating this water so that it can be delivered to customers.</p> <p>(2) The costs of pumping and treating 2,167 acre-feet per year from the wells located downgradient of the VDCR/RF.</p> <p>However, these two different sets of O&M costs can be blended into a single rate, namely \$180 per acre-foot. The cost per acre-foot is divided 10% in admin, 73% in operations, and 17% in maintenance. Replacement costs are already included in the initial (capital) costs.</p>										

Benefits and Costs Summary

The total present value benefits associated with this Project amount to \$24,923,501 in avoided treated imported water supply costs over the expected 50-year project life. The total present value cost of the Project (including capital and O&M costs) is \$15,795,549. The proposed Project will therefore result in total present value net benefits of \$9,127,952.

In addition to monetized benefits and costs, the proposed Project will also result in 5,714 AFY of groundwater storage and recharge, improved water quality in the aquifer, improved water supply reliability, and increased utilization of resources. The “Improve water supply reliability” benefit will likely increase net benefits significantly.

Omissions, Biases and Uncertainties

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In this analysis, the main uncertainties are associated with the avoided water supply costs (due to importing untreated as opposed to treated water). These issues are listed in **Table 8-15**.

Upper Valle de Los Caballos Recharge Project

Benefits and Cost
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Table 8-15. Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided water supply costs (due to importing untreated as opposed to treated water)	—	It is assumed that 100% of the 5,417 AFY of water placed into the spreading basin is ultimately recovered. However, it is unknown how much water will actually be recovered, even with the utilization of downgradient wells; what is ultimately recovered may be less than 100%.
Avoided water supply costs (due to importing untreated as opposed to treated water)	—	It is assumed that 5,417 AFY of water is placed into the spreading basin in order to maximize the amount of water that can be recovered from the new recovery well. However, less than 5,417 AFY could be placed in the spreading basin. In addition, even if 5,417 AFY are placed in the spreading basin, RCWD may decide not to operate the new recovery well at its highest capacity.
Avoided water supply costs (due to importing untreated as opposed to treated water)	U	The costs of Tier 2 untreated and treated MWD in future years are uncertain. The difference in these costs drives the monetized benefits for this project; the larger (smaller) the difference, the larger (smaller) the benefit from undertaking the project.

*Direction and magnitude of effect on net benefits:

+ = Likely to increase net benefits relative to quantified estimates.

++ = Likely to increase net benefits significantly.

— = Likely to decrease benefits.

— = Likely to decrease net benefits significantly.

U = Uncertain, could be + or —.

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Upper Santa Margarita Watershed IRWM Region. *Attachment #5: Upper Valle de Los Caballos Recharge Project Schedule*. March 2013.